

# 11. Group 17

## 11.3 Some reactions of the halide ions

### Paper 1

#### Question Paper

- 1 The colours of the silver halides  $\text{AgCl}$ ,  $\text{AgBr}$  and  $\text{AgI}$  differ.

The solubilities of these halides in aqueous ammonia also differ.

Which row is correct?

	colour of $\text{AgBr}$	silver halide that is most soluble in $\text{NH}_3(\text{aq})$
<b>A</b>	cream	$\text{AgCl}$
<b>B</b>	cream	$\text{AgI}$
<b>C</b>	yellow	$\text{AgCl}$
<b>D</b>	yellow	$\text{AgI}$

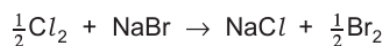
- 2 Compound Q dissolves in water.  $\text{Q}(\text{aq})$  does **not** react with dilute sulfuric acid.

$\text{Q}(\text{aq})$  forms a precipitate when aqueous silver nitrate is added. This precipitate is partially soluble in aqueous ammonia.

What could be compound Q?

- A** barium bromide
  - B** barium iodide
  - C** magnesium bromide
  - D** magnesium iodide
- 3 Which statement about the halogens or halide ions is correct?
- A** Bromide ions react to form a white precipitate when added to silver nitrate solution.
  - B** Bromine does **not** oxidise chloride ions when added to sodium chloride solution.
  - C** Fluorine atoms form cations by accepting electrons when they react.
  - D** Chloride ions are stronger reducing agents than iodide ions.

- 4 Chlorine reacts with sodium bromide.



Which words correctly describe this reaction?

- 1 redox
  - 2 displacement
  - 3 disproportionation
- A 1, 2 and 3
- B 1 and 2 only
- C 1 only
- D 2 only
- 5 When concentrated sulfuric acid is added to solid sodium chloride,  $\text{HCl}$  is formed but **not**  $\text{Cl}_2$ .

When concentrated sulfuric acid is added to solid sodium iodide,  $\text{I}_2$  is formed.

Which statement explains these observations?

- A Sulfuric acid is an oxidising agent and chloride ions are more easily oxidised than iodide ions.
  - B Sulfuric acid is an oxidising agent and iodide ions are more easily oxidised than chloride ions.
  - C Sulfuric acid is a reducing agent and chloride ions are more easily reduced than iodide ions.
  - D Sulfuric acid is a reducing agent and iodide ions are more easily reduced than chloride ions.
- 6 The solids sodium chloride and sodium iodide both react with concentrated sulfuric acid at room temperature.

With  $\text{NaCl}$ , the products are  $\text{NaHSO}_4$  and  $\text{HCl}$ .

With  $\text{NaI}$ , the products are  $\text{NaHSO}_4$ ,  $\text{HI}$ ,  $\text{I}_2$ ,  $\text{SO}_2$ ,  $\text{H}_2\text{O}$ ,  $\text{S}$  and  $\text{H}_2\text{S}$ .

What is the explanation for this difference in products?

- A Chloride ions will displace iodine from the solution.
- B Hydrogen chloride is more volatile than hydrogen iodide.
- C Iodide ions are better reducing agents than chloride ions.
- D Sulfuric acid is able to act as a dehydrating agent with  $\text{NaI}$ .

- 7** Which statement about Group 17 elements and compounds is correct?
- A** Sodium chloride produces chlorine when reacted with concentrated sulfuric acid.
  - B** Sodium chloride produces chlorine when reacted with bromine.
  - C** Sodium bromide produces bromine when reacted with concentrated sulfuric acid.
  - D** Sodium bromide produces bromine when reacted with iodine in aqueous potassium iodide.
- 8** Compound Q is a white crystalline solid which dissolves easily in water.
- When concentrated sulfuric acid is added to a dry sample of Q, steamy white fumes are formed.
- When these white fumes are passed into aqueous silver nitrate solution, a white precipitate forms.
- This precipitate is soluble in dilute ammonia solution.
- What is compound Q?
- A**  $\text{AgCl}$
  - B**  $\text{NaBr}$
  - C**  $\text{NaCl}$
  - D**  $\text{PbBr}_2$
- 9** Solid sodium iodide reacts with concentrated sulfuric acid to form more than one product that contains sulfur.
- What is the lowest oxidation number of sulfur in these products?
- A**  $-2$
  - B**  $0$
  - C**  $+4$
  - D**  $+6$

- 10** The results of tests performed on a white crystalline solid, X, are given in the table.

reagent and conditions	observation
X is gently heated	X sublimes
X is shaken with H <sub>2</sub> O	a colourless solution, Y, forms
Y is warmed with NaOH(aq)	a gas is given off
AgNO <sub>3</sub> (aq) is added to Y	a white precipitate, Z, forms
Z is shaken with NH <sub>3</sub> (aq)	a colourless solution forms

What is the identity of X?

- A** aluminium bromide  
**B** aluminium chloride  
**C** ammonium bromide  
**D** ammonium chloride
- 11** X is the ion of a metal which burns with a red flame.  
 Y is an ion that reacts with concentrated H<sub>2</sub>SO<sub>4</sub> to produce H<sub>2</sub>S.  
 What could be the formula of a compound containing X and Y?

- A** BaBr<sub>2</sub>      **B** BaI<sub>2</sub>      **C** SrBr<sub>2</sub>      **D** SrI<sub>2</sub>

- 12** A 5 cm<sup>3</sup> sample of 0.05 mol dm<sup>-3</sup> sodium chloride is mixed with a 5 cm<sup>3</sup> sample of 0.05 mol dm<sup>-3</sup> potassium iodide. 10 cm<sup>3</sup> of acidified 0.05 mol dm<sup>-3</sup> silver nitrate is then added, followed by concentrated ammonia solution.

What is seen after the addition of an excess of concentrated ammonia solution?

- A** a cream precipitate  
**B** a white precipitate  
**C** a yellow precipitate  
**D** no precipitate

- 13 Which row gives mixtures that **both** result in the oxidation of a halide ion?

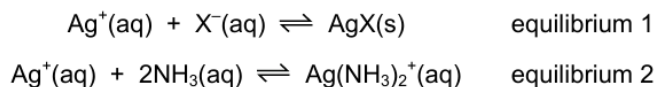
	mixture 1	mixture 2
<b>A</b>	AgNO <sub>3</sub> (aq) and NaCl(aq)	concentrated H <sub>2</sub> SO <sub>4</sub> (aq) and HI(aq)
<b>B</b>	Br <sub>2</sub> (aq) and NaCl(aq)	concentrated H <sub>2</sub> SO <sub>4</sub> (aq) and HCl(aq)
<b>C</b>	Cl <sub>2</sub> (aq) and NaBr(aq)	CH <sub>3</sub> CHBrCH <sub>3</sub> (l) + NaOH (ethanolic)
<b>D</b>	Br <sub>2</sub> (aq) and NaI(aq)	concentrated H <sub>2</sub> SO <sub>4</sub> (aq) and NaBr(s)

- 14 With which compound does concentrated sulfuric acid react **both** as a strong acid **and** as an oxidising agent?

- A** magnesium carbonate  
**B** potassium chloride  
**C** sodium bromide  
**D** sulfur trioxide

- 15 AgNO<sub>3</sub>(aq) is added to a solution of a halide ion, X<sup>-</sup>(aq), and aqueous ammonia is then added.

The ionic equations for the two reactions that occur are shown.



Which statement is correct?

- A** The position of equilibrium 1 lies to the left when X<sup>-</sup> = I<sup>-</sup>.  
**B** Increasing the concentration of ammonia causes the position of equilibrium 1 to move to the left.  
**C** K<sub>c</sub> for equilibrium 2 is larger when X<sup>-</sup> = Cl<sup>-</sup> than when X<sup>-</sup> = I<sup>-</sup>.  
**D** Equilibrium 2 is a redox reaction.

- 16** Sodium azide,  $\text{NaN}_3$ , is dissolved in water. Acidified silver nitrate is added to the solution and a white precipitate forms. Aqueous ammonia is then added to the white precipitate.

The azide ion,  $\text{N}_3^-$ , has similar chemical properties to the  $\text{Cl}^-$  ion.

Which row of the table can be predicted from this information?

	formula of white precipitate	observation on adding aqueous ammonia
<b>A</b>	$\text{AgN}_3$	colourless solution formed
<b>B</b>	$\text{AgN}_3$	precipitate remains
<b>C</b>	$\text{Ag}_3\text{N}$	colourless solution formed
<b>D</b>	$\text{Ag}_3\text{N}$	precipitate remains

- 17** Solid sodium iodide reacts with concentrated sulfuric acid to form more than one product that contains sulfur.

What is the lowest oxidation number of sulfur in these products?

- A** -2                      **B** 0                      **C** +4                      **D** +6

- 18** Concentrated sulfuric acid is added to separate solid samples of sodium chloride, sodium bromide and sodium iodide.

With which samples does sulfuric acid act as an oxidising agent?

- A** sodium chloride only  
**B** sodium chloride and sodium bromide  
**C** sodium bromide and sodium iodide  
**D** sodium iodide only

- 19** Aqueous silver nitrate is added to a solution of potassium iodide.

Aqueous ammonia is then added.

What would be observed?

- A** a cream precipitate that dissolves on addition of aqueous ammonia  
**B** a cream precipitate that does not dissolve on addition of aqueous ammonia  
**C** a yellow precipitate that dissolves on addition of aqueous ammonia  
**D** a yellow precipitate that does not dissolve on addition of aqueous ammonia

- 20** When concentrated sulfuric acid is added to solid sodium bromide, bromine gas is produced, along with a number of other products. However when concentrated sulfuric acid is added to solid sodium chloride **only** hydrogen chloride and sodium hydrogensulfate are produced.

What is the reason for this difference?

- A** Bromine is less volatile than chlorine.
- B** Hydrochloric acid is a weak acid.
- C** Sulfuric acid is not an oxidising agent.
- D** The bromide ion is a stronger reducing agent than the chloride ion.